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PREFACE.

ONE of the most timely papers contributed to the International Scientific Congress of Catholics, which met at Paris, in April, 1888, was undoubtedly that of A. Hernandez y Fajarnes on "La Reforme de la Cosmologie." The distinguished Professor in the University of Saragossa deserves the thanks of us Catholics for having thus publicly called attention to a matter which, it seems, is still at the end of the nineteenth century, treated in some of our higher institutions of learning, as if we were yet living in those long since by-gone ages when Aristotle was the chief, if not only, scientific authority on matters concerning the visible universe. To be brief and plain: The treatises on so-called Special Cosmology in probably the majority of our leading text-books of philosophy, to use a mild phrase, reflect no credit on our scientific progress.

How many of our young men who are studying antiquated cosmological theories, on both sides of the Atlantic, not only waste their precious time, but also get their minds warped by views with which they cannot do anything better than to unlearn them again as fast as possible after leaving their respective *Almae Matres*, to take an active part in the intellectual struggles of the present age. The serio-comic attitude of one of our mediaeval cosmologists with his peculiar phraseology and views, in presence of a man of modern science can hardly be better illustrated than by applying to him the words of St. Paul: "If . . . I know not the power of the voice, I shall be to him, to whom I speak, a barbarian; and he, that speaketh, a barbarian to me." I Cor. 14, 11.

If Catholic science is to exert an influence on the scientific minds of our age, it is nesessary for it to live in the intellectual

atmosphere of now-a-days, to admit the established facts, to know the views, and to speak the language of the present leaders of advanced thought. This, of course, does not imply that Catholic science of now-a-days should reject or ignore anything that is good, sound or true in the grand system of mediaeval, n particular of Thomistic philosophy. No, on the contrary, it is on the sound and true principles of that philosophy, on which Catholic science is to continue to built for all coming ages; yet without adopting the erroneous or unfounded views, especially on matters of Cosmology, which occasionally appear even in the great *Summae* of St. Thomas Aquinas.

While writing the above, *The Catholic World*, March, 1891, was received, in which (p. 820) it is stated: "'Be Thomists, but at the same time be Modernists,' said Archbishop Ireland to the students of the Catholic University of America. 'Be Modernists, but at the same time be Thomists,' says Leo XIII. to the students of the Catholic universities of the world." These few words, no doubt, express the sentiment of all advanced Catholic thinkers and students of philosophy and natural sciences.

May these few pages, with the blessing of God, contribute towards bringing the science of Cosmology among us Catholics up to the standard now-a-days necessary to Catholic Science, if the latter, as in former days, is to fulfil its glorious mission of being the faithful hand-maid of Him who said: "I am the Light of the World; he that followeth Me, walketh not in darkness, but shall have the light of life."

MARCH 7, 1891.

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LEO PP. XIII:

"VOS omnes, Venerabiles Fratres, quam enixe hortamur, ut ad catholicae fidei tutelam et decus, ad societatis bonum, ad scientiarum omnium incrementum auream sancti Thomae sapientiam restituatis, et quam latissime propagetis. Sapientiam sancti Thomae dicimus: si quid enim est a doctoribus Scholasticis vel nimia subtilitate quaesitum, vel parum considerate traditum, si quid cum exploratis posterioris aevi doctrinis minus cohaerens, vel denique quoquo modo non probabile, id nullo pacto in animo est aetati nostrae ad imitandum proponi." Encyclica "Aeterni Patris," 4 Aug., 1879.

* * *

The great respect due to the Scholastic Doctors of the Middle Ages, and in particular to St. Thomas, is a matter too well known among well-informed Catholics to need any further explanation or proof. Yet, these eminent Doctors were not infallible, and in particular not in matters of natural sciences, in which great progress has been made in various directions since the days of Petrus Lombardus, St. Thomas, St. Bonaventure, Albertus Magnus and Duns Scotus. Hence the Holy Father[1] sufficiently intimates that occasionally views or opinions may be found in their writings,

1. Encyclica "Aeterni Patris."

which our age is not expected to adopt. In the following pages some points are to be considered on which the views of modern scientists are at variance with the opinions of the venerable Scholastic Doctors.

COSMOLOGICAL CHRONOLOGY.

It was the almost general, if not unanimous, opinion of the great Mediaeval teachers, that the visible universe had been created in six ordinary days about four or five thousand years before the birth of Christ; and this opinion has been held by some Catholics even up to recent times.

Suarez teaches that Moses speaking of the six days of creation, meant ordinary days ("*de diebus naturalibus . . . intelligendus est*").[2] Athanasius Bosizio declares[3] it an invention of the most recent times ("eine Erfindung neuester Zeit") to say that Moses, in the first chapter of Genesis, intended the word "day" to signify long periods. Cornelius a Lapide[4] concludes his calculations on the chronology before Christ with the words, "*Christus ergo natus est Anno mundi 3950.*" ("Hence Christ was born in the year of the world 3950").—The Roman Martyrology considers the world a trifle older;

2. Theologiae Summa, seu Compendium, a R. P. Francisco Noel, Parisiis, 1877, vol. I, p. 416.

3. Das Hexaemeron und die Geologie, Mainz, 1865, pp. 14–15. Cf. also pp. 352–75.

4. Canones in Pentateuchum.

it says that Jesus Christ was born in the year 5199 after the creation of the world.[5] Even but a few years ago it was considered orthodox doctrine by many that the entire visible world had been created only about six-thousand years ago. For instance, a widely used Bible-History,[6] published about twenty-five years ago, declared quite confidently, "Heaven and earth, and all things therein, God has created out of nothing by His omnipotent will. Since then about 6000 years have passed."

Of late such opinions are rapidly vanishing before the light of facts disclosed by modern scientific investigations. That man already existed at the close of the glacial period, most probably more than six thousand years ago, is now a generally admitted scientific doctrine; there are even scientists of great authority who think that man existed already during, if not before the glacial period.[7] How many countless thousands or millions of years our globe and solar system were in the process of formation before the appearance of man no one can say; yet well established facts indicate that an enormous duration of time must have elapsed between the creation of the primeval cosmical elements and the first dawn of human history.

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5. See Natur und Offenbarung, Muenster, 1872, p. 101.

6. Die Biblische Geschichte .... fuer die katholischen Volksschulen der Vereinigten Staaten Nordamerika's, New York, Cincinnati und St. Louis.

7. Cf. The Catholic World, April, 1889, pp. 23-6; G. Frederick Wright: The Ice Age in North America, New York, 1889, pp. 448-571; Marquis de Nadaillac: Pre-Historic America, New York and London, 1890, pp. 19-20.

Sir William Thompson has stated in a recent lecture, "that the past age of the sun . . . cannot have exceeded twenty millions of years."[8] And Sir J. W. Dawson[9] is of the opinion that since the formation of the oldest Laurentian rocks "about six millions of years, or possibly less" have elapsed. But other scientific authorities assume a greater age of the earth and solar system.[10] At any rate, whatever the precise age of the world may be, no well informed person will now-a-days believe that but a few thousands of years ago the Creator called the entire visible universe into existence.

GEOGRAPHY.

The views of the great ancient and mediaeval Christian teachers concerning geography, have proved as erroneous, as their opinions on cosmological chronology. Some claim[11] that both Plato and Aristotle were convinced of the earth's rotundity and the existence of antipodes. But these views were gradually discarded by Christian teachers. St. Jerome considered it "a foolish

8. Cf. Sir J. W. Dawson: Modern Science in Bible Lands, New York, 1889, p. 175.

9. L. c.

10. Cf. Joseph Le Conte: Elements of Geology, New York, 1887, p. 275; and Alexander Winchell: World-Life or Comparative Geology, Chicago, 1883, pp. 355, 364–5.

11. Cf. Charles Woodruff Shields: Philosophia Ultima or Science of the Sciences. New York, 1888, Vol. I, pp. 34 and 43; and John William Draper: History of the Conflict between Religion and Science, New York, 1875, pp. 63–5.

concert of philosophers that there are two hemispheres whose inhabitants stand with feet opposite."[12] Lactantius considered it absurd that trees on the other side of the earth, hang downward, or that inverted men walk beneath us. St. Augustine considered it impossible that men should exist on the other side of the earth, because the Sacred Scriptures make no mention of them in the list of the descendants of Adam. Cosmas Indicopleustes, an Alexandrian monk of the sixth century, represented the earth "as an oblong plain," bounded by seas, and covered with a crystal roof. Since then it had been considered orthodox opinion "that the earth was a sea-girt plain, beyond which no mortal could pass." When the learned Virgil or Feargil, of Ireland, bishop of Salzburg, in 756,[13] revived the opinion that human races do live on the opposite side of the earth, he raised a storm of protest throughout Christendom. The question seemed permanently settled until Columbus conceived the daring idea of discovering India by sailing in a direction west of Europe. The matter was seriously discussed at Salamanca, before a council of learned men: professors of various scientific branches, prominent friars and dignataries of the Church. Columbus soon found himself in danger of being convicted, not merely of error, but even of heresy. Passages from the Old and New Testament, and from various Fathers and Doctors of

12. Charles Woodruff Shields: L. c.

13. Dr. Johannes Alzog: Universalgeschichte der christlichen Kirche, 7th edition, Mainz, p. 480.

the Church, as St. Chrysostom, St. Augustine, St. Jerome, St. Basil, etc., were quoted to prove beyond any reasonable doubt the impossibility of the existence of antipodes.[14] Yet, notwithstanding the opinions of the learned ecclesiastics, Columbus was right. His discoveries forever refuted the opinion maintaining the impossibility of the existence of antipodes.

THE RELATIVE PLACE OF THE EARTH IN THE SIDEREAL WORLD.

Another scientific opinion on which the greatest Christian teachers of ancient and mediaeval times were in error, was that the earth is the physical centre of the visible universe. Plato, it is believed by some,[15] was of the opinion that the earth moves around the sun, but did not dare to say so plainly. About a hundred years later, Aristarch of Samos plainly taught the "heliocentric system," and reaped persecutions for his audacity. Finally, about the year 140, after Christ, Ptolemy[16] appeared, who for fourteen centuries remained the standard authority on astronomy, among both Mohammedans and Christians. According to his opinion, the earth is the immovable centre of the vis-

14. See Washington Irving: The Life and Voyages of Christopher Columbus, Vol. I, Book II, Chapt. III.

15. J. G. Wollweber: Der Himmelsglobus, Freiburg i. B., 1888, p. 213.

16. Cf. l. c., p. 215, and Dr. Albert Stoeckl: Lehrbuch der Geschichte der Philosophie, Mainz, 1870, p. 142.

ible universe; and around it are successively the spheres of the Moon, Mercury, Venus, the Sun, Mars, Jupiter, Saturn, etc. This view which was also held by Aristotle, was adopted by the great mediaeval teachers. Thus, for instance, St. Thomas[17] teaches: "The relation of the earth to the heavens is that of the centre to the circumference. But around one centre there can be many circumferences. Hence, one earth existing, many heavens are assumed to exist (una terra existente, multi coeli ponuntur)."

The great poet and admirer of St. Thomas, Dante Alighieri, explains this further by saying:[18] "The first (heaven) is that where the Moon is; the second . . . where Mercury is; the third . . . where Venus is; the fourth . . . where the Sun is; the fifth . . . where Mars is; the sixth . . . where Jupiter is; the seventh . . . where Saturn is; the eighth is that of the stars; the ninth is not visible, save by the motion mentioned above, and is called by many the Crystalline; that is, diaphanous, or wholly transparent. Beyond all these, indeed, the Catholics place the Empyrean Heaven; that is to say, the Heaven of flame or luminous; and this they suppose to be immovable."

How this mediaeval error was dispelled by Copernicus and Galileo, is too well known to be explained here. We now know that the earth, instead of being the grand hub around which the visible universe revolves,

17. Summa Theologiae I, 68, 4 ad 1.

18. Convito II, 4., Longfellow: The Divine Comedy of Dante Alighieri Boston, 1881, p. 607.

is but "a floating island, a hamlet in this great solar country, and this solar empire itself only a province in the depths of infinite starry space," as a great modern astronomer observes.

CHEMISTRY.

Aristotle taught that the terrestrial bodies are essentially different from the sidereal.[19] According to his opinion no change or alteration, generation or corruption, takes place within the heavenly spheres. Hence he concluded that the sidereal bodies consist of a peculiar, the so-called fifth element, which is essentially different from the four elements, earth, water, air and fire, of which the terrestrial bodies are composed.[20] The great mediaeval teachers, Albertus Magnus and Duns Scotus,[21] as also St. Thomas, who looked upon Aristotle, in purely scientific matters, as the philosopher *par excellence*, adopted this opinion. St. Thomas,[22] discussing the question whether all bodies had the same formless matter ("*materia informis*"), lays down the principle, that all bodies having the same matter may be transmuted ("*quaecumque conveniunt in materia, sunt*

19. Tilmannus Pesch, S. J.: Institutiones Philosophiae Naturalis secundum Principia S. Thomae Aquinatis, Friburgi i. B., 1880, p. 319.

20. Dr. Albert Stoeckl: Lehrbuch der Geschichte der Philosophie, Mainz, 1870, pp. 142-3.

21. Dominicus Palmieri, S. J.: Animadversiones in Recens Opus de Mente Concilii Viennensis, Romae, 1878, pp. 38-9

22. Summa Theologica, I, quaestio 66, art. 2.

transmutabilia ad invicem"). But as this is not the case between sidereal and terrestrial bodies, he concluded that they have not the same matter. But all terrestrial bodies, consisting of the four elements, may be mutually transmuted, and have consequently the same formless matter. Father Salvator Tongiorgi, S. J., truly suggests[23] that if St. Thomas lived now-a-days, he would undoubtedly follow not Aristotle, but modern scientists in purely scientific matters ("S. Thomas si nunc viveret, profecto Peripateticus non esset"). Since the discovery of spectrum analysis we know that throughout the entire visible universe all bodies consist of specifically the same chemical elements, as sodium, carbon, oxygen, iron, calcium, hydrogen, lead, etc.[24] Father Angelo Secchi, S. J., alone examined the spectra of more than 6000 fixed stars,[25] and many other modern astronomers have carefully made similar examinations, with the result of completely exploding the Aristotelian opinion of the existence of a peculiar, or fifth, element in the sidereal bodies, specifically different from the terrestrial elements.

Just as unfortunate as with his opinion concerning the peculiar matter of the sidereal world, was Aristotle with his theory by which he endeavored to account for the substantial changes continually going on with terrestrial bodies. He took it for granted that all these

23. Institutiones Philosophicae, editio decima, Parisiis, vol. II, p. 223.

24. Spectrum Analysis Explained, Boston, 1872; J. Norman Lockyer: Studies in Spectrum Analysis, New York, 1878.

25. Dr. Joseph Pohle; P. Angelo Secchi, Koeln, 1883, p. 8.

bodies were composed of but four elements: earth, water, air and fire; and that these may be mutually transmuted. He believed that burned matter was transformed into air; that air was changed in the clouds into water; and that warm water again evaporated into air.[26]

On this foundation of defective and erroneous observation, which was very excusable at a time when the microscope and modern chemical analysis were still things of the distant future, Aristotle built his famous theory of first matter and substantial form, which was afterwards adopted by the Scholastics.[27]

Since in all substantial changes of terrestrial bodies a permanent substratum remains whilst new properties appear, Aristotle assumed that two principles concur in completing terrestrial corporeal substances, or concrete bodies: the one he called first matter; the other, substantial form. The first matter he considered to be the passive, indeterminated and common substratum of all terrestrial bodies, from which their extension arises; whereas the form, gives the bodies their specific nature or properties.[28] Hence when a terrestrial body is substantially changed, the material substratum, or first matter remains the same, but a new substantial form

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26. See Tilmannus Pesch, S. J., L. c., pp. 319 and 322; Dr. Albert Stoeckl: L. c., p. 142.

27. Summa Theologica I, quaestio 66, art. 2; Summa contra gentiles, liber II, cap. 18.

28. J. Van der Aa, S. J.: Praelectiones Philosophicae Scholasticae, Lovanii, 1888, vol. II, p. 89; and P. Vallet, P. S. S.: Praelectiones Philosophicae, Parisiis, 1884, vol. II, pp. 175-9.

takes the place of the former one. Consequently the axioms were adopted, "By the corruption of one body another is generated"; and "By the generation of a new body another is corrupted"; that is, loses its specific nature.

St. Augustin and St. Thomas adopted this opinion,[29] and the Scholastics generally developed its logical consequences both in relation to inorganic and organic bodies.[30] Hence this theory gained for some centuries undisputed credence among Catholics until the philosophy of Descartes (1569-1650) began to call it in question by treating it as a useless fiction that contributes nothing towards explaining physical phenomena.

Legrand, for instance, declared that the substantial alterations of bodies are no proof for any necessity of admitting the so-called first matter; for these alterations occur because bodies give up certain constituents whilst other elements take their places.[31]

With the revival of the Scholastic philosophy in more recent times, the theory of first matter and substantial form has again come prominently to the front in Catholic schools of philosophy, and we find it defended by such widely known philosophical authors as, for instance, Cardinal Zigliara, San Severino, Dr. Stoeckl, Vallet and Van der Aa.

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29. P. Vallet: L. c., pp. 188-9.

30. Summa Theologica I, 66, 2; Opusc. de Principiis Naturae; Summa Philosophica, liber III, cap. 22; Summa Theologica, I, 118, 1; I, 71, I, 90, ad 2; Summa Philosophica, liber II, cap. 87; etc.

31. Dr. Karl Werner: Franz Suarez und die Scholastik der letzten Jahrhunderte, Regensburg, 1861, vol. II. p. 74.

Yet the fact is manifest that a most decided and probably growing opposition to this theory, as far as it is intended to explain physical phenomena has arisen even in Catholic circles.

For instance, Palmieri[32] plainly declares his disagreement with the "Perpatetics" on this question. He even accuses them[33] of entertaining a certain contempt of natural sciences (*contemptus quidam scientiarum naturalium*), "because they see that evident facts are advanced by the latter, which cannot well be harmonized with their theories."

Tongiorgi,[34] one of the clearest and most reliable Catholic authors on philosophy, quite satisfactorily proves, as it seems to us, his proposition, "*Scholasticorum theoriae de corporum principiis merito a recentioribus rejiciuntur.*" He justly remarks: "Since our age, for the benefit indeed of philosophy, is turning its attention to the recultivation of the doctrines of the Scholastics, it is to be feared that there are some who, ignoring the progress of physical science since the times of the Scholastics, imagine that they may follow those great leaders indiscriminately in all things". This remark is no doubt well founded. After comparing a number of our most widely known Catholic philosophical authors on the question mentioned, one can hardly avoid coming

32. Institutiones Philosophicae, Romae, 1875, vol. 2, pp. 104-176; and in his Animadversiones in Recens Opus De Mente Concilii Viennensis, Romae, 1878.

33. Institutiones Philosophicae, vol. 2, p. 169.

34. Institutiones Philosophicae, editio decima, Parisiis, vol. II, pp. 212-23.

to the conclusion that the strict Scholastic orthodoxy of some of them is fairly in proportion to their ignorance of the very elementary principles of modern chemistry.

Another prominent Catholic philosopher, Dr. George Hagemann,[35] Professor of Philosophy in the Academy at Muenster, declares, as plainly as Father Tongiorgi, that the Scholastic theory on the constitution of bodies cannot be held now-a-days; at least not in its strictly Scholastic form. He says, "The advances of exact investigation have actually established other results concerning the constitution of the corporeal world than those on which the Peripatetic view was based."

These philosophers are backed by the practically unanimous consent of unprejudiced modern scientists on this point. Who of the latter now-a-days thinks of defending the Aristotelian view? Father Angelo Secchi, for instance, probably the greatest Catholic authority on matters concerning the constitution of physical bodies, observes:[36] "Now we also comprehend how vain it is to attempt to construct the universe *a priori*; and likewise we see the fruitlessness of the endeavor of all those persons who believe they have explained all nature by again giving currency to two scholastic expressions used in ancient times, but who do not perceive that the difficulty of the explanation exactly lies in defining what that *matter* is, and wherein that *form* consists, of which they talk to us". In

35. Metaphysik, Freiburg i. B., 1884, p. 81.

36. Die Groesse der Schoepfung (translated by Dr. Carl Guettler), Leipzig and St. Louis, 1885, 4th edition, p. 85.

another lecture,[37] Father Secchi even suggests that the Aristotelian theory, according to which new forms are educed out of the potency of matter[38] has a tendency of favoring modern Materialism. For if it is granted that not only vegetative life but also the animal soul with its various sensitive faculties may spring from the potency of matter (*"educi de potentia materiae"*),[39] it will certainly not be difficult to go a step further and to assume that even thought may arise from the same source, and consequently also the human soul. And indeed some scientists who hardly intend to follow an anti-Christian materialistic tendency have already drawn the conclusions intimated by Father Secchi by assuming, that the human soul is simply "the final outcome of Nature";[40] or, "that the spirit of men *was* developed out of the *anima* or conscious principle of animals, and that this, again, was developed out of the lower forms of life-force, and this in its turn out of the chemical and physical forces of Nature."[41] In view of modern Materialism, the thorough-going defenders of the Aristotelian matter and form-theory may do well to pause and reflect on Father Secchi's intimation before

37. L. c. p. 14.

38. St. Thomas: Summa Theologica I, quaestio 90, art. 2, ad 2.; Summa Philosophica, Liber III. cap. 22.

39. Cf. St. Thomas: Summa Theologica I, quaestio 90, art. 2, ad 2; and quaestio 118, art. 1.

40. Asa Gray: Natural Science and Religion, New York, 1880, p. 105.

41. Joseph Le Conte: Evolution and Its Relation to Religious Thought, New York, 1888, p. 295.—Cf. also William S. Lilly: Ancient Religion and Modern Thought, London, 1885, pp. 336-45.

running the risk of providing the enemy with weapons to be used against themselves.

Impartial scientists are at present agreed on the following points regarding the essential constitution of bodies: 1, specifically the same chemical elements exist throughout the entire visible universe, and constitute all known bodies; 2, the number of these elements is about seventy, as far as we know by chemical and spectrum analysis; 3, as far as observations and experiments can at present reach, these elements are unchangeable as to their nature, or specific properties; 4, the properties of molecules are but the sum of the properties of the constituent atoms;[42] and the properties of bodies are but the sum of the properties of their constituent molecules. Whether these elements, or some of them, might yet be dissolved into more primary ones; whether there exists some one primary element of which all now known chemical elements are composed;[43] whether atoms in the strictest sense of the word do exist;[44] or whether these hypothetical ultimate atoms are or not, alike: these are questions still open for dispute. Besides the ponderable chemical elements, there exists an imponderable matter diffused throughout the entire visible universe, called ether, whose

42. Dr. George Hagemann: Metaphysik, Freiburg i. B., 1884, p. 85.

43. Cf. T. H. Huxley: The Advance of Science in the Last Half Century, New York, 1887, p. 49-63; A. Secchi: L. c. vol. II, p. 275.

44. T. H. Huxley: L. c., p. 54; Dr. Lothar Meyer: Modern Theories of Chemistry, London, 1888, p. 109; J. B. Stallo: The Concepts and Theories of Modern Physics, New York, 1888, pp. 86-92.

vibrations are believed to be the cause of heat, light, color, chemical action, electricity and magnetism.[45]

The various interactions of the ponderable chemical elements and the imponderable matter, called ether, are at present considered by scientists sufficient to account for the various phenomena of the inorganic world.[46] Even the so-called life of plants, pre-supposing the formation of the original germs by the Creator, is at present accounted for by scientists of great authority by the various interactions of the chemical elements of the plants and their immediate surroundings, and the vibrations of the ether.[47]

Thus modern chemistry leaves no standing room for the Aristotelian theory of first matter and substantial form, as far as the substantial changes of inorganic bodies and plants are concerned; in this respect the only safe place of refuge for that theory seems to be the sublime and misty heights of metaphysical abstraction.

SOME OBJECTIONS ANSWERED.

It may be proper to answer here some objections that may be raised against the views just expressed both from scientific and theological standpoints.

45. J. H. Pepper: Cyclopaedic Science Simplified, Philadelphia, pp. 1 and 14; P. Angelo Secchi: Die Einheit der Naturkraefte (translated by Prof. Dr. L. Rud. Schulze).

46. Dr. Joseph Pohle: P. Angelo Secchi, Koeln, 1883, p. 107-26.

47. P. Angelo Secchi: Die Einheit der Naturkraefte, Leipzig, 1885, vol. II, pp. 351-7; Dr. Engelbert Lorenz Fischer: Ueber das Princip der Organisation und die Pflanzenseele, Mainz, 1883, pp. 126-33; and Salvator Tongiorgi: Institutiones Philosophicae, editio decima, Parisiis, vol. III, pp. 15-27.

It may be urged that some scientists consider it possible that there may exist some one primary matter, of which all known chemical elements are ultimately composed; and that perhaps this primary matter is the so-called ether.[48] Now T. H. Huxley[49] suggests that "this ethereal" "Urstoff" "of the modern corres_ ponds very closely with the . . . (first matter) of Aristotle, the *materia prima* of his mediaeval followers." This is to be denied; for even this primary matter, if it really exists, however minute its atoms might be, would be endowed with extension and specific properties; which latter the followers of Aristotle never claimed for their first matter.

But may not the theory of first matter and substantial form be applied at least to the ultimate elementary atoms of which terrestrial bodies consist? Not in the sense of Aristotle and his followers. For these considered the substantial forms of the terrestrial elements to be something transmutable, whereas modern chemistry holds the immutability of the properties of the ultimate chemical atoms.[50] Cardinal Zigliara[51] claims that the question concerning the essential principles of bodies is not a physical but a metaphysical one.

We reply that Aristotle and his followers did not consider the first matter and the substantial forms as

48. Cf. P. Angelo Secchi: L. c. p. 275.

49. The Advance of Science in the last half-century, New York, 1887, p. 60.

50. S. Tongiorgi: L. c., vol. II, pp. 240-5; Dr. Lothar Meyer: Modern Theories of Chemistry, London, 1888, pp. 355-69.

51. Summa Philosophica editio sexta, Lugduni & Parisiis, 1887, vol. II, pp. 64-5.

mere metaphysical abstractions but as concrete realities continually manifesting themselves in physical phenomena.[52] Hence, Father Tongiorgi, quoted by Zigliara,[53] is quite correct in saying: "In this matter we are to proceed not *a priori* but *a posteriori* by observations and experiments: hence the whole affair is a physical one." Zigliara[54] himself in explaining the system of the Scholastics on this point admits that they taught that "there exists not only ontologically but also physically in the nature of corporeal beings a physical and real subject (called first matter) and a physical and real substantial form, of which as mutually distinct but united principles every body is really composed and substantially constituted."

In view of this admission it seems strange that Zigliara[55] defends the proposition, "*Quaestio de corporum principiis essentialibus non physica sed metaphysica est.*"

How Zigliara agrees with himself or the Scholastics on this point, we do not care to discuss; yet we may add, that although the question as to the essential composition of bodies is primarily a question concerning physical science, yet it may also be secondarily treated metaphysically.

Father Russo[56] observes: "The common division of essence is into metaphysical and physical. This

52. For instance, St. Thomas: Summa Theologica I, 66, art. 2.
53. L. c.: p. 61.
54. L. c.: p. 68.
55. L. c.: p. 64.
56. P. Nicolaus Russo: Summa Philosophica, Bostoniae, 1885, pp. 134–5.

division is to be understood so that the essence is said to be physical when its essential constituents are considered as they are in themselves, without any artificial division. This, if the essence is physically composed, is done by considering its physical parts; as if, for instance, man is said to consist of body and the rational soul. But the essence is called metaphysical . . . when the constituents of a being are considered according to the common and the specific part, or their genus and difference; as, when man is said to be a rational animal."

Hence we admit that the question concerning the essence of bodies may be treated also metaphysically, by considering abstractly their *genus proximum* and *differentia specifica*. In this sense one may say that all bodies are extended realities endowed with specific properties. To this Liberatore seems to narrow down the Scholastic theory when he says:[57] "The whole Scholastic system is reduced to this, that bodies consist of a twofold principle: one, which is the first root of extension; and the second, which is the first root of activity. The first is called matter; the second, form." But is this exactly what Aristotle and the Scholastics claimed for the first matter and the substantial forms? Certainly not, as explained above.

From a theological point of view, it might be advanced that the General Council of Vienne, 1311-2,

57. Matthaeus Liberatore: Institutiones Philosophicae, Romae, 1861, p. 459.

sanctioned the Scholastic theory of first matter and substantial form by solemnly defining that any one is to be considered a heretic[58] who shall assert, defend, or pertinaciously hold, that the rational or intellectual soul is not immediately and essentially the form of the human body ("quod anima rationalis seu intellectiva non sit forma corporis humani per se, et essentialiter").

It is not necessary for our present purpose to examine the precise drift of the definition of this Council; Palmieri has done this ably in his "Animadversiones in Recens Opus De Mente Concilii Viennensis, Rome, 1878."—It suffices to note that the Council speaks only of man, and not of inorganic bodies or plants. Hence we may deny with modern scientists, without danger of colliding with the decision of the Council, that there is any physical and real, or concrete, first matter or substantial form, in the sense of Aristotle and the Scholastics,[59] in either inorganic bodies or in mere plants.

If there is any resting place in the inorganic nature for the Scholastic theory of first matter and substantial form it must be in the ultimate material elements, whether we may call them molecules or atoms. Hence, one of our most profound Catholic philosophers, E.

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58. Brother Azarias: Aristotle and the Christian Church, London, 1888, p. 109.

59. Cf. Zigliara: L. c., vol. II, p. 68; and St. Thomas: Summa Theol. I, quest. 66, art. 2 (This article of St. Thomas deserves especial attention, if any one wishes to learn what the Scholastics meant by *materia prima* and *forma substantialis*).

Domet De Vorges,[60] observes: "Les savants arriveront toujours a un premier element materiel. C'est la que je les attends, c'est la que j'etablirai solidement la theorie scholastique. Quel que soit ce premier element, corps, molecule ou atome, je dirai qu'il est composé de matiere et de forme."

But we cannot agree with the esteemed philosopher just mentioned when he continues: "Quelle preuve en donnerai-je, si la preuve tiree de transformation chimiques m'a echappe? J'en donnerai pour preuve la vie. Ces elements, quels qu'ils soient, entrent ou peuvent entrer dans les vivant, et la ils manifestent de proprietes nouvelles, irreductibles, qui ne peuvent s'expliquer que par un changement intime. Ce changement implique necessairement une forme qui change et une matiere qui demeure." Not at all; it is an antiquated view that life, or a life-giving principle, whether in plant, or animals, or man, changes the intrinsic nature of the ultimate chemical elements, molecules or atoms. These remain the same whether in or outside of an organized body.[61] Hence, the scholastic view of a changing form and a permanent matter ("une forme qui change et une matiere qui demeure") is, according to the present state of chemical science, inadmissable even as far as the most ultimate possible chemical elements or atoms are concerned.

60. Annales de Philosophie Chretienne, Paris, Mars 1889, p. 621.

61. See Elroy M. Avery: The Complete Chemistry, New York and Chicago, p. 194, 315; Edward L. Youmans: A Class-Book of Chemistry, New York, 1868, pp. 404-5; and R. J. Harvey Gibson: A Textbook of Elementary Biology, London, 1889, pp. 21-50.

The only final resting place which the Scholastic theory of form and matter may find in inorganic nature is that which St. Thomas has reserved for it in the sidereal bodies, when he observed,[62] "Relinquitur ergo quod materia corporis coelestis secundum se considerata non est in potentia nisi ad formam quam habet." If the theory of matter and form is to be applied to the ultimate molecules or atoms, of which all bodies of the visible universe are composed, we must say, according to the present state of chemical science, that these ultimate molecules or atoms can naturally have only the form which they have; as it is the only one given them by the Creator, and, so far as human observation reaches, cannot be altered by any created agency.

THE VITAL FORCE OF PLANTS.

The Scholastics applied their theory of first matter and substantial form to explain also the nature of plants, animals and man. Let us compare their views on plants, as expressed by their modern followers, with those of modern scientists. M. Liberatore, S. J.,[63] says, "the vital principle in plants is the same thing as their substantial form .... Vegetation occupies the lowest degree of the operations of life ... Life ... consists in the immanence of action. For this two things are required: that the action proceeds from an internal

62. Summa Theol.: I, quest. 66, art. 2.
63. Institutiones Philosophicae, Romae, 1861, p. 504, 509.

principle; that it remains in the same subject from which it proceeds." P. Vallet[64] declares: "Some physiologists wrongly contend that the nature of the vital principle is unknown to us. It does, indeed, not fall under the perception of experience, but is inferred by reasoning with the help of the vital phenomena. Hence, it may be defined, a certain simple, active (actuosum) principle, endowed with spontaneous power, one, bound to the organs, substantial, but incomplete in the line of substance, from which the living being receives its species, unity and all its powers, and exercises them. Hence it is the principle not of life alone, but also of . . . the physical and chemical forces."

Cajetan Can. Sanseverino[65] and other prominent Catholic philosophical writers maintain similar mediaeval views on this point; but the quotations given above will suffice for the present.

It may, probably, be asserted with safety that mainly such Catholic philosophers as have not given themselves any considerable trouble to get acquainted with the results of modern chemical and biological investigations still uphold, with a zeal worthy of a better cause, the mediaeval views that the so-called vital principle, is not only the principle of plant-life but also of the physical and chemical forces working in plants. Salvator Tongiorgi, S. J.,[66] on the other hand, expresses the views now generally held by men who

64. Praelectiones Philosophicae, Paris, 1884, vol. II, p. 198.
65. Philosophiae Compendium, vol. II, Naples, 1884, p. 128.
66. Institutiones Philosophicae, Editio Decima, Paris, vol. III, p. 21–26

have not closed their eyes to modern scientific progress, when he observes, "It is to be admitted that there are certain peculiar forces in plants, which do not operate in inorganic matter. But these forces seem to be nothing else, than various results of the mechanical and chemical forces, as these are working under the conditions of the organism." Father Tongiorgi compares the plants to delicately constructed machines and declares,[67] "If man had eyes sufficiently sharp to perceive the individual atoms of both ponderable and imponderable matter, and hands fit to handle these atoms and to dispose them according to the first type constructed by God, then, I believe, man could make plants."

Father Tongiorgi evidently did not consider *a forma substantialis*, or a vital principle, any more necessary to explain the vegetative phenomena of mere plants, than to explain the music of a pipe-organ, or the motion of a locomotive. Each plant is formed of various unchangeable chemical elements; and the life it seems to have is not from some one internal principle, but the result of the manifold interactions of its various chemical constituents under the influence of heat, light, gravitation, capillary attraction, etc.

Dr. Engelbert Lorenz Fischer[68] says, "Since the essential being of a plant . . . consists in a peculiar systematic arrangement of its parts, also the . . . so-

67. L. c., p. 26.

68. Ueber das Princip der Organisation und die Pflanzenseele, Mainz, 1883, p. 129.

called plant-soul will be nothing else than the system of the immaterial forces existing in the organic molecules and working harmoniously together."

This is, no doubt, the view now generally accepted among scientists of the nature of so-called plant-life. We shall quote yet one scientific authority on the subject, Father Angelo Secchi. In his famous work on *The Unity of the Physical Forces*,[69] he says: "There has been many a controversy as to wherein the essence of Vital Force consists, and still up to our time many have held the opinion that the Vital Force is essentially different from the physical forces to which matter is subject. But this view may admit various interpretations. If it is meant, that an especial principle is necessary to call forth a certain cycle of activities and to keep them agoing, a principle without which the animal body is subject to the forces of ordinary chemistry, then it is quite correct. If on the other hand this assertion is intended to be understood that by means of the Vital Force a source of force dwells in the living animal, independent of the ordinary molecular activities, and that a chemistry is making itself felt in it, which is different from the one controlling the inorganic elements (Stoffe), then this is false."—What Father Secchi says of the Vital Force of the animal body applies *a fortiori* to that of plants. In the following he explains his view more clearly: "The

69. Die Einheit der Naturkraefte, Leipzig, 1885, vol. II, pp. 353, 360, 365 369.

idea of organism presupposes as the first principle a certain arrangement by means of which the parts of which the body consists are enabled to produce a two-fold activity; namely, first to develop an activity outwardly; and, secondly, to co-operate in the preservation of the machine itself. But such an arrangement cannot arise of itself in lifeless matter, but depends on what we would call the germ. In this germ various conditions are fulfilled which, as far as our experience reaches, can never be satisfied by a mere meeting of the parts of lifeless matter. To explain our views somewhat clearer, we will call attention to the ordinary machines, although the comparison is not completely fitting.—For instance, to produce a steam-engine it is not sufficient to bring together iron, coal, water, etc., but one must distribute these elements properly and subordinate one to the other; or, in other words, one must *bring* the entire material *into a certain form*. This form is nothing substantial, it consists in nothing else than in a favorable arrangement of the single parts . . . If . . . the form has once been given, then the physical forces commence their activities and can now produce effects, which cannot be called forth in any other way . . . Similarly in the organism: the union of oxygen, hydrogen and carbon, which are in any way mixed together, will never produce a living, organic molecule, and even if the relative proportions had been measured with absolute accuracy . . . To produce any organized being the conscious activity of

the Eternal Architect is required . . . His operation is here just as necessary for producing the form, as it was required to give existence to lifeless matter, and to impart to it thereby the first motion."

It may not be amiss to add here what Father Secchi says of the possibility of so-called spontaneous generation and on the cause of the relative stability of living organisms.

After freely admitting that various so-called organic products may be produced artificially, he emphatically declares that no organized substance, or organism, can be thus called into existence. Then he continues: "The *generatio spontanea*, or the original production of an organism (Urzeugung) by mere forces of lifeless matter, is an absurdity and not a single fact can as yet even most remotely serve as a support for this assumption. Yet let us suppose it mere possible that by some chance, even though by some very improbable one, once many different molecules would happen to unite themselves and to form a complete organism. If the motion of these molecules will still continue, they will without delay disperse again in space before they would have yet confirmed themselves in their mutual situation, unless one of these two conditions would be fulfilled in favor of this confirmation: either the molecules must, by a series of other influences, be confined to a sequence of regulated motions—but this is in contradiction to the idea of accident,—or they must, by a higher law to which they are subject, be forced to

remain in this situation as soon as they once came into the same. This last hypothesis shows, that the *generatio spontanea* is not exactly mathematically impossible, but that it presupposes that matter is already before subject to a definite law which cannot consist merely in the motion and the accidental meeting of the atoms."

How do organisms in the midst of continual changes preserve their relative stability? Father Secchi answers: "Should any one ask, how is it possible, that all . . . various modifications of the organisms preserve and renew themselves, we would not hesitate to declare, that they cannot do this from their own power, but that this is done only by the continually operating activity of the same First Principle which has called them out of nothing and without which they would fall back into nothing. The Creator is not like a mechanic who leaves the machine which he has built, so that it will now exist and work for itself: but the preservation is in the true sense a continual re-creation, and no being has by the very fact of its having a place allotted to itself in the world already received the right to continue to exist; but it exists only so long as it is supported by the Divine Will which has called it into existence."

THE PRINCIPLE OF SENSATION, OR THE ANIMAL SOUL.

The modern view of the so-called Vital Force of plants we may briefly recapitulate in the following

words of Father Secchi:[70] "The chemical activities which go on (in the plant) under the influence of light and heat may be imitated in our laboratories and brought about artificially: but the manner in which they are produced we cannot imitate. Aside from this we find nothing in plants that would transgress the limits of chemistry and physics: so that the arrangement of the organized matter in union with the motion proceeding in a certain form, seems to suffice to explain the processes in which the life of plants consists. In their tendency to personify everything, the ancients ascribed these activities to a *plant-soul*; but they may be the simple result of the arrangement of the parts and of the operation of physical forces."

The theory of a plant-soul, as a physical reality, being generally discarded by scientists now-a-days, we may next inquire, what do they think of the principle of sensation, or of the animal soul?

Emil Du Bois-Reymond, in his famous speech at the meeting of German scientists and physicians at Leipzig, Aug. 14, 1872, expressed the following views: Even in the grandest tropical forest we may behold nothing but matter in motion (bewegte Materie): yet "with the first sensation of pleasure or pain, which in the beginning of animal life on earth a most simple being felt," we are confronted with a mystery which modern science cannot explain by any combinations or interactions of ponderable and imponderable atoms or mole-

70. L. c., p. 365.

cules. "By no conceivable arrangement or motion of material particles," Emil Du Bois-Reymond[71] observes, "can a bridge be made over into kingdom of consciousness .... What conceivable connection does there exist between certain motions of certain atoms in my brains on the one hand, and on the other hand, the to me original undefinable, indisputable facts, 'I feel pain, I feel pleasure; I taste something sweet, I smell the odor of roses, I hear the tone of an organ, I see something red.'"

Father Secchi[72] expresses the same views when he says: "It would be just as wrong to deny to physical forces activities which they possess, as to ascribe them others which they do not possess. Thus certain processes in matter, if considered superficially seem to presuppose the existence of a principle external to it, or another substance: thus the ancients believed that a soul was dwelling in rubbed amber and in the magnet; but when the facts were analyzed more carefully and considered in connection with others, these forces resolved themselves into simple motions of matter. The same may be asserted also of the vegetal force that proceeds from any organism. But neither this nor any other force that operates in it can in any way account for the principle of sensation, and still less for that of intelligence, that dwells in it."

From this we see that according to modern scientific

71. Ueber die Grenzen des Naturkennens. Ein Vortrag, Leipzig, 1872, p. 25.

72. L. c., p. 362.

views, the processes going on in plants can be accounted for without assuming any intrinsic vital force or soul, just like the operations of machines may be explained in a similar manner. But not even the lowest form of sensation of any organism can be satisfactorily accounted for without assuming the existence of some principle physically distinct from the ponderable or imponderable elements operating in the organism.

Hence, we cannot agree with Dr. St. George Mivart, when he says:[73] "An organism may be considered of as being the visible expression and manifestation of an immanent principle—an immaterial reality, the psyche or soul. Thus, understood, it must be the soul which makes the living organism what it is, though it has no actual existence apart from the matter it vivifies . . . We say 'organism,' and not 'animal,' because a principle of individuation or 'psyche,' must, we think, be admitted to exist in plants if it exists in animals." There is an essential difference between the principle of sensation which pervades the animal organism, and the *plan* according to which a plant is built up of chemical elements, and in accordance with which it operates in obedience to chemical and physical forces.

With all respect due to Dr. Mivart, we prefer to hold with Fathers Secchi and Tongiorgi,[74] and modern scientists generally: 1, There is nothing in the vegetative processes of plants which seems to necessitate the

73. On Truth, London, 1889, pp. 426-7.

74. Institutiones Philosophicae, Edit. 10, Paris, vol. III, pp. 17, 21, 42, 43.

assumption of any vital force or life-giving principle, distinct from the physical and chemical forces operating in the organism. 2, The peculiar processes going in plants are but the result of the physical and chemical forces, operating under the conditions of the organism; that is, in accordance with the plan pre-arranged in the germ by the Creator. 3, But animal sensation even of the most imperfect kind, is inexplicable without the assumption of a new principle pervading the animal body or most intimately united with it, and physically distinct from the physical and chemical forces operating in or on the animal organism.

What, then, is the intrinsic nature of this principle, or animal soul?

The Scholastic view is thus expressed by leading modern Catholic philosophers: "The soul of the brutes is not material in the manner in which a body is material; its body is something 'composed of matter and form.' But the soul of brutes is a form, but not the composite itself of matter and form. Therefore, it cannot be some body . . . The animal soul is not an immaterial form, or one that subsists for itself, but belongs to the genus of material forms, yet so that it comes next to immateriality." "The animal soul comes into existence by generation;" or, "the sensitive soul is brought forth out of the potency of matter in brutes." "The animal soul separated from the body cannot perform any kind of operations . . . Therefore, it cannot remain even in being . . . It may be said

that the animal soul perishes because after the dissolution of the animal composite, it is dissolved *per accidens* (quod, corrupto composito animali, *per accidens* corrumpatur)."[75]

P. Vallet[76] expresses the same views: "The animal soul depends intrinsically on matter both in its actions and in its nature . . . (It is) not created by God, but produced by generation . . . The body being dissolved it perishes, in as far as it ceases to be by accident."

J. Van der Aa, S. J.,[77] defends the following propositions: "The animal soul does not subsist in itself but depends in its existence on matter . . . The animal souls are not created, but produced by generation . . . The animal soul . . . ceases to exist when the animal perishes."

As long as the Scholastic view of first matter and substantial form seemed to be the true key for unlocking the mysteries of the created universe, the views just mentioned were accepted without protest by Catholic schools of philosophy. But with the progress of modern chemistry and biology serious doubts began to arise in the minds of many as to the correctness of these Scholastic views. The Aristotelian opinion, held even by St. Thomas,[78] that living animals may be pro-

75. Signoriello: Philosophiae Christianae . . . Cajetani Can. Sanseverino Compendium, Naples, 1884, vol. II, pp. 138-45.

76. Praelectiones Philosophicae, Paris, 1884, vol. II, pp. 201-10.

77. Praelectionum Philosophiae Scholasticae Brevis Conspectus, Louvain, 1888, vol. II, pp. 223-8.

78. Summae Theologicae I, quaest. 71 and 118, art. 1; cf. Dr. Carl Guettler: Naturforschung und Bibel, 1877, p. 135.

duced out of the potency of inorganic matter under the influence of sidereal bodies has already generally been discarded as inconsistent with all thus far carefully observed or examined pertinent facts; and the somewhat similar view that the animal souls are called "into being by some corporeal agents transmuting matter from potency to act by some corporeal virtue which is in them,"[79] is also meeting with decided opposition among otherwise sincere admirers of the great Scholastic Doctor. Thus, for instance, Dominicus Palmieri, S. J.,[80] declares: "The animal soul is a substance, . . . complete and . . . simple . . . But a simple substance cannot be made except by creation; therefore, when the soul of brutes is made, it is made by creation." As the animal soul is created by God, so, according to Palmieri,[81] it is also annihilated by God, after having accomplished its end. Also Salvator Tongiorgi[82] defends the following opinions: The animal soul is something simple and indivisible . . . It is not brought forth out of the potency of matter, as Aristotle and the Scholastics believed. It is a substance. It cannot come into existence except by creation. It depends on the body as to all its operations; but it does not from its nature (ex se) depend on the body as to its existence (esse). Finally, the animal soul ceases to exist after its separation from the body, but not

79. Summae Theologicae I, quaest., 118, art. 1.
80. Institutiones Philosophicae, Rome, 1875, vol. II, p. 345.
81. L. c., p. 354.
82. Institutiones Philosophicae, Editio decima, Paris, vol. III, pp. 42-5.

owing to its own corruption, but because of its annihilation.

The great Spanish philosopher James Balmes[83] also seems to incline to the opinion that the animal soul is, as to its existence, not depending on matter. Besides, whilst it may not contradict sound philosophy to assert, that the souls of animals are really annihilated, he asks: "Who has told us, that the vital force existing in the animal has no further purpose after the destruction of the organism to which it gave life?"

From all this we see that the confidence in the correctness of the Scholastic views on the nature, origin and end of the animal soul has been seriously undermined in recent times. What, then, are we to put in place of these Scholastic views?

What is the origin of the animal soul? The Scholastics, as stated before, believed "anima sensitiva educitur de potentia materiae in brutis;—the animal soul is brought forth out of the potency of matter."—Modern science answers: The only two forms of matter we know anything of are ponderable matter, or the chemical elements, and imponderable matter, or the so-called ether, the vibrations or undulations of which, are considered by Father Secchi[84] and others to be the cause of heat, light, electricity, magnetism and of chemical, molecular and molar attraction. But neither

83. Fundamente der Philosophie, Regensburg, 1885, vol. II, pp. 12-15.

84. Cf. Dr. Joseph Pohle: P. Angelo Secchi, Koeln, 1883, pp. 107-126; and, P. Angelo Secchi: Die Groesse der Schoepfung (translated by Dr. Carl Guettler), Leipzig, 1885, p. 48.

ponderable nor imponderable matter, nor both combined, as the words of Du Bois-Reymond and Father Secchi show, can account in the least for even the simplest act of sensation. Hence we must discard the opinion that the animal soul derives its origin from matter. It is something physically distinct from and in natural perfection far above anything material we know of. It can consequently also not be a mere quality or property of the animal organism; for if this were the case, it could be accounted for by some interactions of the ponderable and imponderable matter, operating in the organism. Being the principle which endows the organism with the faculty of sensation, locomotion, etc., it is *a source* of activity or energy, and as such it cannot be a mere so-called *accidens* which only affects or modifies the organism; as quantity, quality, relation, action, passion, situation, duration, motion, rest, etc. But it must be *something substantial;* that is, something *existing* independently of the mere material organism, although it *operates*, as far as we can perceive, only in union with it, since all acts of the sensitive faculties, as seeing, hearing, imagining, instinctive promptings, etc., require some material organ.

Assuming, then, the animal soul—both in the simplest amoeba and in the most perfect bird or quadruped—to be *a source* of activity, or energy, or work-power, physically distinct from the material elements and physical and chemical forces of the animal organism, and as such, some substance, we may

next inquire, is this substance simple or composed of parts? Is it indivisible or not?—All animals have, though in different degrees, the various sensitive faculties: of sensation, of sensitive appetite, of instincts, etc. Now, notwithstanding the diversity of sensitive faculties, the animal appears to be and to remain as long as it lives an identic living and acting unit. This would seem to imply that that source of its unity, or the animal soul, must be something one or simple, that is a simple substance. Being this, it would seem that it could come into existence only like other substances, that is by a creative act of God.[85] If this will seem incredible to some let them remember that the work of Creation is not yet completed, but is still going on according to the plan laid down for Himself by the Creator. Thus, for instance, it is the generally held Catholic doctrine of both philosophers and theologians, that each human soul is created by God.[86] Why were it impossible, or even improbable, that God should still continue, according to a certain order established by Himself, to call animal souls successively into existence, to give life to the new organisms that are being continually generated?

But what is to become of the animal soul when the organism it inhabited is dissolved? It is the common

85. Cf. Salvator Tongiorgi, S. J.: Institutiones Philosophicae, Editio decima, Paris, vol. III, p 45; and, Dominicus Palmieri, S. J.: Institutiones Philosophicae, Rome, 1875, vol. II, p. 345.

86. Ch. Cardinal Zigliara: Summa Philosophica, Lyons and Paris, 1887 vol. II, pp. 165-6; S. Tongiorgi: L. c., p. 109; etc.

opinion of mankind that the animal soul ceases to exist with the dissolution of the organism which it inhabited. If we ask for the reason of this general opinion, we find it to be, that people see no reason why the animal soul should survive the body.[87] In the first place, it is urged, the animal soul has only sensitive faculties, and these cannot be exercised without the bodily organism. And, secondly, the animal, not being responsible for its acts, being irrational, deserves neither reward nor punishment in a life to come. Hence, with the dissolution of the animal body its end is accomplished, and therefore the Creator will permit its soul to relapse into non-entity, or annihilate it.[88]

But what proofs have we for these assumptions? Who has ever demonstrated that the animal soul freed from its organism may not have specific activities of its own—just as well as, for instance, oxygen freed from its union with hydrogen, in water, or carbon, freed from its union, in carbonic acid gas? Who has ever proved that, because the animal souls may deserve neither reward nor punishment in a future life, that therefore there is no further place for them in the wide universe?

Perhaps Catholic philosophers would do well, in the absence of stringent proofs on such points, to confess their ignorance or at least suspend their judgment. The great Spanish philosopher, James Balmes, ex-

87. Cf. D. Palmieri, S. J.: Institutiones Philosophicae, Rome, 1875, vol. II, pp. 352–4.

88. Cf. D. Palmieri, L. c.; and S. Tongiorgi: L. c., p. 45.

pressed the opinion[89] that it is not contrary to sound philosophy to hold that the animal souls will be annihilated, yet he also declared, that it would not be untenable to hold that they continue to exist after the dissolution of the animal organism. He says: "Of what purpose would they be? I know not; but the assumption is probably not forbidden that they . . . might not be useless. Just as little do we know to what purpose many other beings serve, and yet we do not therefore deny their existence or call in doubt their usefulness. Who has told us that the vital force existing in an animal has no further purpose after the organism is destroyed to which it had given life?"

THE HUMAN SOUL: ITS ESSENTIAL DIFFERENCE FROM THAT OF THE ANIMAL, AND ITS RELATION TO THE HUMAN BODY.

St. Thomas[90] lays down the general principle, "In the souls of brutes no operation superior to those of the sensitive kind can be found; for they have no intelligence, nor reason; which is evident from this that all animals of the same kind operate in a like manner as if operating, moved by nature, and not from design (arte)." This view has not been contradicted by any reliable and careful modern observations. Dr. St. George

89. Fundamente der Philosophie, Regensburg, 1855, vol. II, p. 15.
90. Summa Contra Gentiles, Liber II, cap. 82.

Mivart,[91] one of the greatest modern authorities in this matter, declares: "We do not hesitate to affirm that there is no known action of any brute animal which cannot be fully explained by its possession of . . . merely sensitive faculties . . . The so-called 'intelligence, understanding, and knowledge' of animals are not really true intelligence, understanding, and knowledge. They are the sensuous simulation of such intellectual faculties . . . Many persons eagerly note and are prone to exaggerate any action of animals which show, as they think, true intelligence, but, as a rule, they fail altogether to observe phenomena which bespeak a want of intelligence . . . Acts which would be reckoned as signs of extreme obtuseness and stupidity in us, are common enough amongst animals usually reckoned as the most intelligent . . . What dog that has seen fuel put upon fires again and again, ever puts on any himself to maintain the heat he so greatly enjoys? Apes have been said to warm themselves at deserted fires, yet no one asserts that they have made them up."

On these points, then, there exists perfect harmony between the Scholastic philosophers and unprejudiced modern investigators, that animals have no faculties higher than the sensitive; and that man has, besides and above these, intelligence, or reason.

The proofs advanced by the Scholastics in favor of the immortality of the human soul have also not in the least been impaired by any modern discoveries. Hence,

91. On Truth, London, 1889, p. 347, 354, 355.

we may dismiss these points and consider next the Thomistic and the modern scientific views on the relations between the human soul and the human body.

The opinion of St. Thomas which is still defended by some modern authors, as, for instance, P. Vallet[92] and J. Van der Aa,[93], is briefly as follows: The human soul is the only substantial form of the body. Being a superior form it contains virtually and eminently the inferior forms. Hence J. Van der Aa lays down the following proposition: "In homine nulla est alia forma substantialis praeter animam rationalem, et per hanc homo non solum est homo, sed animal, et vivum, et corpus, et substantia, et ens."

And P. Vallet declares: "Triplex operatio convenit corpori; nempe sensitiva, vegetativa, et simpliciter physica. Porro anima confert corpori principium triplicis hujus operationis.—Corpus ab anima vitam et sensum habere a cunctis hodie admittitur, exceptis materialistis. . . . Restat ergo ut impraesentia ostendamus corpus ab anima haurire principium virium suarum physicarum."

According to this view, then, the human soul gives to the body not only the sensitive faculties, but is also the source of the physical and chemical forces operating in the human organism. What are we to think of this view?

Does the human soul impart a specific essence or

92. Praelectiones Philosophicae, Paris, 1884, vol. I, pp. 396—405.

93. Praelectionum Philosophiae Scholasticae Brevis Conspectus, Liber V, pp. 106—10.

nature to the material, or chemical, elements of which the human body is composed? The Thomists answer affirmatively. According to their view the soul is united with the body as with *materia prima*,[94] and consequently imparts to this matter its specific essence or nature. This is contradicted by modern chemistry, which claims that the human body or organism, consists of certain chemical elements whose intrinsic essence, or nature, remains unchanged whether united with the soul or not. Borden P. Bowne observes[95]: "So far as analysis goes every organism can be resolved into elements, all of which are found in the inorganic state. It appears as a highly complex material aggregate, with peculiar laws and with a peculiar unity of its own. Besides, the freest use is made in the organism of laws and principles which obtain in the inorganic realm . . . The entire body, indeed, seems to be a very complex aggregate of physical and chemical processes."

Father Secchi expressed[96] the same opinion: "The elements and chemical forces, building up organic combinations, are by no means different from the ordinary elements . . . There is not the least doubt that the elementary parts of an organic molecule, in consequence of their affinity, combine in the animal body exactly in the same way as they would do outside

94. Cf. C. Mazella, S. J.: De Deo Creante, Woodstock, Md., 1877, pp. 433—7; J. Van der Aa: L. c., p. 107.

95. Metaphysics, New York, p. 326.

96. Die Groesse der Schoepfung, pp. 39-40.

of the organism, if they would find there precisely the same conditions of heat, electricity, . . . etc."

Thus, according to modern chemistry, the human organism, like that of the animal, consists of certain chemical elements, the intrinsic nature of which is unchangeable as far as observation reaches, and which consequently in this regard are not altered by the influence of the soul.

But, is not the soul at least the main spring of the vegetative functions of the human organism? The mediaeval Scholastics, and their modern followers again unhesitatingly answer in the affirmative. Father M. Maher, S. J.,[97] defends the following propositions: 1, "The vegetative principle in man, and in fact in all living organisms, is a special force or energy superior to the chemical and mechanical properties of matter." 2, "In man this vital principle is identical with the rational sentient soul."

Also Tongiorgi, although he denies the existence of a vegetative principle in plants,[98] nevertheless defends[99] the view that "the rational and sensitive soul is also the principle of vegetative life in man." The main reasons advanced by him in support of this view are drawn from the intimate connections existing between the sensitive and vegetative functions of man. Quite different from plants, man, like animals, feels hunger,

97. Catholic Manuals of Philosophy (Stonyhurst Series). Psychology, pp. 504–8.

98. Institutiones Philosophicae, vol. III, pp. 21–7.

99. L. c., pp. 63–7.

thirst, selects his food, chews and swallows the same. Besides, the nerves on which digestion, circulation of blood, respiration and secretions depend, are *mixed* nerves, containing in the same involucrum both sensory and motor fibers united. Since at least the sensory fibers are animated by the soul, the nerves to which the vegetative functions are subject are consequently also under the continual influence of the soul. Moreover the vegetative life continues, as long as the sensitive lasts; but if the latter ceases also the former ends. This seems to show that both are depending on the same life-giving principle, the soul. Besides, the influence of the passions, of the imagination, and of mental operations or emotions on the vegetative functions of man, seem to confirm the view that the rational and sensitive soul is also the source, or main spring, of the vegetative life of the human body, or organism.

But since about the middle of the present century a different view has been gradually gaining ground among scientific men on this point.

Dr. J. R. Mayer is said[100] to have been the first who, in his treatise, "Die Organische Bewegung in ihrem Zusammenhange mit dem Stoffwechsel, Heilbronn, 1845," "distinctly set forth the principle that the source of all changes in the living organism, animal as well as vegetable, lies in the forces acting upon it *from*

100. Cf. The Correlation and Conservation of Forces: A Series of Expositions, New York, 1886, p. 405.

without; whilst the changes in its own composition brought about by these agencies, he considers to be the immediate source of the forces which are generated by it."

In a treatise "On the Mutual Relations of the Vital and Physical Forces," published 1850, Dr. William B. Carpenter aimed to show[101] "that the general doctrine of the 'Correlation of the Physical Forces' . . . was equally applicable to those vital forces which must be assumed as the moving powers in the production of purely physiological phenomena; these forces being generated in living bodies by the transformation of the light, heat, and chemical action supplied by the world around, and being given back to it again, either during their life, or after its cessation, chiefly in motion and heat, but also to a less degree in light and electricity."

In a more recent treatise,[102] Dr. Wm. B. Carpenter observes, that the prevalent opinion on the nature and origin of the so-called vital force "has until lately been that this power is inherent in the *germ*; which has been supposed to derive from its parent not merely its material substance, but a *nisus formativus, Bildungstrieb*, or *germ force*, in virtue of which it builds itself up into the likeness of its parent, and maintains itself in that likeness until the force is exhausted, at the same time imparting a fraction of it to each of its progeny." But, "when we look carefully into the question, we find that

101. Cf. L. c., p. 407.
102. L. c., pp. 411—2.

what the *germ* really supplies is not the force, but the *directive agency* . . . The actual constructive force, as we learn from an extensive survey of the phenomena of life, is supplied by heat, the influence of which upon the rate of growth and development, both animal and vegetable, is so marked as to have universally attracted the attention of physiologists, who, however, have for the most part only recognized in it a *vital stimulus* that calls forth the latent power of the germ, instead of looking upon it as itself furnishing the power that does the work. It has been from the narrow limitation of the area over which physiological research has been commonly prosecuted, that the intimacy of this relationship between Heat and the Orginizing force has not sooner become apparent."

This or similar views on the origin and nature of the so-called vital force of plants and animals including the human organism, are now widely held by scientific men. It would be an easy matter to multiply quotations on this point from various authors, but we will conclude with giving the opinion of Father Secchi. Speaking[103] of the development of animal organisms, he observes that there must, in the first place, be a beginning, that is, an "organized matter;" or, what we may call an embryo, or germ, whose atoms or molecules are so pre-arranged as to develop a certain fixed order of (so-called) vital processes. "If this beginning is once made, the further development can probably go on

103 Die Groesse der Schoepfung, p. 41.

through the operations of the natural chemical laws without the aid of forces of a higher order, as we observe it to be the case with plants."

Dr. E. L. Fischer[104] admits, what also Father Secchi, no doubt, never intended to deny, that the human soul exerts some morphotic, or plastic, influence on the development of the human organism; but the extent of this influence cannot clearly be learned from experience or observation. About all we know on this point are the following facts: Culture and morality may within certain limits change the physiognomy of persons; certain mental states or emotions may express themselves in the human organism, retard or accelerate the vegetative functions; and, in some cases, certain mental states or experiences of mothers may even impress themselves on the organisms of their yet unborn children.

This is about all we know from actual observation of the plastic or vegetative influence of the soul on the human organism. To the other main argument in favor of this influence, drawn from the fact that with death, or the departure of the soul, the vegetative functions of the human organism cease, Dr. Fischer replies: "It is not the soul that leaves the body, but in a certain sense the reverse: the body leaves the soul; that is, since its organic functions stop and finally cease altogether, ... the soul has no more any organ for its cativities and must leave *nolens volens*."

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104. Ueber das Princip der Organisation und die Pflanzenseele, Mainz, 1863, pp. 134–44.

From all this we see how widely different opinions are now-a-days held even among Catholics on the influence of the human soul on the vegetative functions of the human organism.

The present state of the controversy on the nature of the so-called vital force, in general, we can hardly illustrate any better than by quoting the words of representatives of the most opposite views. Father M. Maher, S. J.,[105] calls attention to the following characteristic differences between living organisms and inorganic matter: 1, structure; 2, chemical constitution; 3, origin and reproduction; 4, growth, conservation, and decay ——, and then remarks: "These various features mark off by an impassible barrier the living organism from dead matter: and the set of phenomena mentioned in the two last arguments form against *Organicism* a cogent proof of the existence in living beings of a special dominating principle or energy superior to the properties and forces of inanimate substances . . . . We are justified, then, in assuming a new internal energy, a directing force which determines and governs the stream of activities described as the phenomena of life. This force is what is meant by the so-called 'vegetative soul,' or 'vital principle.'" On the other hand, an author, quoted disapprovingly by Father L. Dressel, S. J.,[106] declares: "It is simply ridiculous to talk of vital

105. Psychology, pp. 504–8.

106. Der belebte und der unbelebte Stoff, Freiburg i. B., 1883, pp. 203–4

force otherwise than of an unknown X, the value of which may finally turn out to be = 0. Only ignorance and mental lethargy are, in the present state of natural sciences represented by the defenders of a vital force, which does all, which explains all, and of which no one can tell, where it is hidden, how it works, by what laws it is bound. The savage calling a locomotive a living animal, is no more ignorant than the scientist speaking of a vital force in the organism."

As to the influence of the human soul, in particular, on the vegetative functions of the human organism, these two points seem to be certain: In the first place, the soul exercises some such influence, as the facts mentioned before indicate; and as we may also infer from the physiological fact that the sympathetic nervous system,[107] which is, no doubt, animated by the soul, controls the functions of the heart, stomach, liver, etc. To what extent the influence of the soul is here active, is, and probably always will remain a mystery.[108] Secondly, besides the influence of the soul, there are also physical and chemical forces at work in building up, repairing, or changing the human organism.

Hence, the strictly Thomistic view still defended by some authors, as Vallet and Van der Aa, that the soul is united with the body as with *materia prima*, and that consequently it alone supplies all forces working in the human organism, can now-a-days be defended no more

107. Cf. Roger S. Tracy: The Essentials of Anatomy, Physiology, and Hygiene, New York, 1887, pp. 174-82.

108. Cf. Philosophisches Jahrbuch, Fulda, 1888, pp. 162-8.

by any one acquainted with the leading results of modern chemistry and biology. Probably no scientist of any note will now-a-days deny the following points: 1, The human organism consists of chemical elements, the intrinsic nature or properties of which are not changed by any influence of the soul. 2, With these chemical elements of the human organism, " we must not expect to meet any forces or laws of combination different from those of inorganic chemistry."[109]

THE THEORY OF EVOLUTION.

It was the general belief during the Middle Ages, that the visible universe was created within six ordinary days a few thousand years before Christ; and that the sun, moon, stars and the earth, and its plants and animals had ever since remained specifically the same. With modern astronomy, geology, palaeontology and biology the now widely held view gradually gained ground, that both the inorganic and the organic realms of the universe were of long and slow evolutionary growth, according to a well-defined plan, the execution of which began with the creation of the primeval material elements and culminated with the appearance of man on earth.

The followers of the Scholastic philosophers, of course, decidedly reject the theory of evolution, es-

109. Cf. Elroy M. Avery: The Complete Chemistry, New York, Chicago, p. 315.

pecially in organized nature. For instance, Dr. Mathias Schneid, in a recently published work[110] still confidently holds "that God has directly put into existence the first individuals of each species;" though he admits that various races and varieties have arisen within these species. It would be easy to quote similar views from various philosophical textbooks, claiming to follow faithfully the doctrines of St. Thomas. Yet the theory of evolution has within the last ten years been gaining ground so rapidly not only outside of the Catholic Church, but also among well-informed Catholics, so that its opponents will probably soon be "rari nantes in gurgite vasto." The most prominent Catholic scientific defender of this theory, within certain well-founded limits, is Dr. St. George Mivart.[111] In his recent work "On Truth"[112] he observes: "The causation of the universe is intelligent, since otherwise the First Cause would not have been adequate to produce that intelligence which we know to exist in ourselves. As we have seen (p. 453) that universe could never have been submitted to the action of natural selection, nor could the law of uniformity which pervades it be due to natural selection either. Neither could the primary laws, properties, and powers of the other primary materials of the universe have been due to it, nor the incipient stages of the first living organisms,

110. Naturphilosophie im Geiste des hl. Thomas von Aquin, Paderborn, 1890, p. 338.

111. See *The Forum*, New York, March, 1887, pp. 9-10.

112. London, 1889, pp. 526-9.

nor even those indifferent or even slightly disadvantageous characters, which form the definition of so many species. The action of 'natural selection' itself could never have been educed by 'natural selection.' It was, therefore, preordained, and it follows that everything the evolution of which its action helps on, must have been preordained likewise. Evolution, therefore, is, and must be, a process full of purpose and replete with design which exists, not only at its root and origin, but accompanies it at every step of its progress."

Having laid down the general principles: 1, that the action of mere physical forces cannot account for the evolution of the inorganic and organic worlds; and 2, that evolution is and must be a process preordained and accompanied at every step of its progress by its First Cause, God, —— there seems to be no intrinsic reason why evolution could not be admitted by Catholics within the following limits: 1, God having first created the primeval material elements of which the sidereal bodies, the earth included, consist, permitted these under His guiding providence to be gradually developed, in the course of countless thousands or millions of years up to their present state. 2, When the earth began to be fit to receive them, God created some most simple plants and animal organisms, and endowed them with the necessary potency to produce in the long course of geological ages the various vegetal and animal organisms that have existed and still do exist on earth. 3, And to come to the point

that seems to shock some Catholics most, as far as the theory of evolution is concerned, why should it be intrinsically impossible, that "God may have formed the *body* of Adam out of the organism of some highly developed animal, which He modified as much as was requisite, and then infused with a rational soul?"—Father M. Maher, S. J.,[113] justly remarks: "Whatever real dignity man has got comes from the soul, not from the body; and in any case it is not easy to see that an animal organism, developed to as high a state of perfection as physical laws can bring it, is baser material to form the body of man than the 'slime' of the earth. . . . On the grounds of reason alone there can, it seems to us, be no cogent argument framed against such a hypothesis when carefully stated. It is indisputable that God *could* form the body of the first man as easily out of a living organism as out of dead matter. And were the general doctrine of evolution *demonstrated* as regards all other animal organisms, there would in the light of pure reason be obviously—from the likeness of the life history of the individual human body to that of the brute—a fair presumption in favor of a similar origin."

The author, in a communication read before the section on philosophical sciences of the "Congres Scientifique International des Catholiques," at Paris, April 9, 1888,[114] defended the intrinsic possibility of evolu-

113. Psychology (Stonyhurst Series) pp. 542-3.
114. See Reports, Tome Premier, pp. 179-83 and 408-10.

tion within the limits indicated. The official report states: "L'assemblee parait divisee en deux fractions assez nettement tranchees: les uns trouvent trop larges les concessions fait par le Rev. Gmeiner a la theorie de l'evolution; les autres, tout en se joignant a l'auteur pour maintenir, a titre de *minimum*, les restrictions qu'il convient d'apporter a la theorie relativement a l'homme, accordent volontiers qu'il n'y a point d'impossibilite philosophique a admettre dans le regne vegetal et animal la doctrine d l'evolution."

This evidently shows that the theory of evolution within the limits indicated is gaining ground in Catholic scientific circles, where a few years ago it was generally looked upon with decided antipathy.

* * *

Having indicated some points of importance on which Catholic mediaeval Cosmology evidently needs correction now-a-days, the author sincerely hopes that abler minds will continue to work in bringing the science of Cosmology among Catholics up to the standard imperatively demanded now-a-days, both by modern science and by the honor of the Catholic Church, whose glorious privelege it was, in ages now gone by, to lead the advance-guard even in matters of purely secular knowledge. To such as may consider it a duty of Catholic piety to hand down with religious care from generation to generation, even the now-a-days worse than useless husks of mediaeval philosophical formulas, we recommend to reflect on the following

words of a wide-awake Catholic writer:[115] "In the spiritual order, as in the physical, to live is to change; to cease to change is to cease to live. A formula is but the robe of truth. And, as truth lives and grows in the mind, whether of the individual or of the race, its vesture becomes too straightened for it. He is not only a bad philosopher, but, little as he may deem it a deadly foe to mankind, who seeks to elevate any bygone forms . . . into absolute types; who can dream of no future for humanity, but the resuscitation of a past, which assuredly is dead and will not return .... In my judgment, the greatest peril of the present age lies in this: that those who profess to be teachers of religion and defenders of the faith so seldom endeavor honestly to follow out the lines of thought familiar to earnest and cultivated men of the world."

115. W. S. Lilly: *The Forum*, New York, December, 1886, p. 328.

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